

Preface

The aim of this book is to give a short mathematical introduction to piecewise deterministic Markov processes (PDMPs) and to present biological models where they appear. The book is divided into six chapters. In the first chapter we present some examples of biological phenomena such as gene activity and population growth leading to different type of PDMPs: continuous-time Markov chains, deterministic processes with jumps, dynamical systems with random switching and point processes. The second chapter contains some theoretical results concerning Markov processes and the construction of PDMPs. The next chapter is an introduction to the theory of semigroups of linear operators which provide the primary tools in the study of continuous-time Markov processes. In the fourth chapter we introduce stochastic semigroups, provide some theorems on their existence and find generators of semigroups related to PDMPs considered in the first chapter. The next chapter is devoted to the long-time behaviour (asymptotic stability and sweeping) of the stochastic semigroups induced by PDMPs. In the last chapter we apply the general results, especially concerning asymptotic behaviour, to biological models.

The book is dedicated to both mathematicians and biologists. The first group will find here new biological models which lead to interesting and often new mathematical questions. Biologists can observe how to include seemingly different biological processes into a unified mathematical theory and deduce from this theory interesting biological conclusions. We try to keep the required mathematical and biological background to a minimum so that the topics are accessible to students.

Acknowledgements

This research was partially supported by the National Science Centre (Poland) Grant No. 2014/13/B/ST1/00224. The authors are grateful to Michael C. Mackey and Katarzyna Pichór who read the manuscript and made useful suggestions for improvements.

Katowice, Poland
May 2017

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Piecewise Deterministic Processes in Biological Models

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2017, IX, 169 p. 10 illus., Softcover

ISBN: 978-3-319-61293-5